

WHAT IS CLAIMED IS:

1. An optical fiber coupler comprising:

a plurality of optical fibers including a λ_1 -band optical fiber and a λ_2 -band optical fiber,
5 fused together at a fusion-elongated portion, wherein, in the fusion-elongated portion,
each of the plurality of optical fibers tapers to a respective narrower outer diameter,
relative to an outer diameter of the optical fiber outside the fusion-elongated portion,
wherein the λ_1 -band is different from the λ_2 -band, and
wherein a propagation constant difference between the optical fibers is 10^{-4} rad/ μm or
10 smaller.

2. An optical fiber coupler comprising:

a plurality of optical fibers including a λ_1 -band optical fiber and a λ_2 -band optical fiber,
fused together at a fusion-elongated portion, wherein, in the fusion-elongated portion,
15 each of the plurality of optical fibers tapers to a respective narrower outer diameter,
relative to an outer diameter of the optical fibers outside the fusion-elongated portion,
wherein the λ_1 -band is different from the λ_2 -band, and
wherein at least outside the fusion-elongated portion, the λ_1 -band optical fiber is a
single mode optical fiber at a wavelength in the vicinity of $0.98\ \mu\text{m}$,
20 wherein at least outside the fusion-elongated portion, the λ_1 -band optical fiber
comprises a first core, a second core surrounding the first core and having a radius
within the range of $10\ \mu\text{m}$ or greater, and a cladding surrounding the second core, and
wherein a relative refractive-index difference of the second core and the cladding is
0.1 % or smaller.

25 3. An optical fiber coupler according to claim 2, wherein a relative refractive-index
difference of the first core and the cladding is within a range from 0.7 % to 0.9 %.

4. An optical fiber coupler according to claim 3, wherein the λ_2 -band optical fiber is a
30 single mode optical fiber at a wavelength in the vicinity of $1.55\ \mu\text{m}$.

5. An optical fiber coupler according to claim 2, wherein a relative refractive-index difference of the first core and the cladding is within a range from 0.6 % to 0.8 %.
- 5 6. An optical fiber coupler according to claim 5, wherein the λ_2 -band optical fiber is a single mode optical fiber at a wavelength in the vicinity of 1.55 μm .
7. An optical fiber for an optical fiber coupler comprising:
a first core;
10 a second core surrounding the first core and having a radius within the range of 10 μm or greater; and
a cladding surrounding the second core,
wherein a relative refractive-index difference of the second core and the cladding is 0.1 % or smaller, and
15 wherein the optical fiber for the optical fiber coupler is a single mode optical fiber at a wavelength in the vicinity of 0.98 μm .
8. An optical fiber for an optical fiber coupler according to claim 7, wherein a relative refractive-index difference of the first core and the cladding is within a range from 0.7 %
20 to 0.9 %.
9. An optical fiber for an optical fiber coupler according to claim 7, wherein the refractive-index difference of the first core and the cladding is within a range from 0.6 %
25 to 0.8 %.
10. An optical fiber coupler comprising:
a λ_1 -band optical fiber having a first core with a radius of r_1 , a second core with a radius of r_2 surrounding the first core, and a cladding surrounding the second core;
a λ_2 -band optical fiber including a core with a radius of r_3 , and a cladding surrounding
30 the core; and

a fusion-elongated portion where the λ_1 -band optical fiber and the λ_2 -band optical fiber are fused together, each of the optical fibers in the fusion-elongated portion tapering to a respective narrower outer diameter, relative to an outer diameter of the optical fibers outside the fusion-elongated portion,

- 5 wherein the λ_1 -band is lower in wavelength than the λ_2 -band, and
 wherein $r_1 < r_3 \leq r_2$.

11. An optical fiber coupler according to claim 10, wherein a propagation constant
10 difference between the λ_1 -band optical fiber and the λ_2 -band optical fiber is 10^{-4} rad/ μm
 or smaller.

12. An optical fiber coupler according to claim 10, wherein a relative refractive-index
15 difference of the second core and the cladding of the λ_1 -band optical fiber is 0.1 % or
 smaller.

13. An optical fiber coupler according to claim 10, wherein a relative refractive-index
15 difference of the first core and the cladding of the λ_1 -band optical fiber is within a range
 from 0.7 % to 0.9 %.

- 20 14. An optical fiber coupler according to claim 10, wherein said λ_1 -band optical fiber is a
 single mode optical fiber at a wavelength in the vicinity of 0.98 μm , and said λ_2 -band
 optical fiber is a single mode optical fiber at a wavelength in the vicinity of 1.55 μm .